

## ABSORBENT ARTICLE WITH IMPROVED FASTENING SYSTEM AND METHOD OF FASTENING THEREOF

### BACKGROUND OF THE INVENTION

The present invention pertains to absorbent articles, such as training pants,  
5   diapers, incontinence garments and the like, and more particularly, to a  
mechanical fastening system for such absorbent articles.

Such absorbent articles generally comprise a liquid-impermeable barrier  
sheet, a liquid permeable body side liner and an absorbent medium between  
them. They generally include some type of attaching system for fitting the article  
10   to the wearer. In many such applications, the fastening system is preferably  
refastenable so that the article can be temporarily removed and then refastened to  
the wearer.

One common form of mechanical attachment systems is the so called  
hook-and-loop system which comes in various forms and has both advantages  
15   and disadvantages in its application to such absorbent articles. For example,  
particularly with disposable diapers, the fasteners are secured to the garment in  
the front and back, generally in such a manner that the hook portions of the  
fasteners on each side are pulled over the loop portions to secure the garment to  
the wearer. In typical such installations the loop material is relatively unstretchable  
20   and either forms a portion of the garment itself or is attached to the surface of the  
garment. The hook panel is generally stretchable while the hook is generally  
unstretchable so that it can be positioned on the loop material for adjustment to  
the size and shape of the wearer of the garment.

A disadvantage of this type of hook-and-loop system is the tendency of the hooks to separate from the loop material when the wearer is active, such as when stooping or bending as is common with a child in training pants. This disengagement failure can result in requiring it to be refastened. This produces an undesirable inconvenience and disadvantage of such a mechanical fastening system for such applications. In an attempt to overcome this disadvantage many systems have increased the force to disengage through various enhancements to maximize the hook-and-loop material interaction.

#### SUMMARY OF THE INVENTION

10 The present invention overcomes the above-described difficulties and disadvantages associated with such prior art mechanical fastening systems by providing, in particular embodiments, a hook-and-loop fastening system in which the loop material is a stretchable material that is in an elongated state before contact is made with the hook material and is then contracted on the hook material after contact.

15 One aspect of the present invention concerns a disposable absorbent article. In one embodiment, the disposable absorbent article comprises: a body having first and second regions; a mechanical fastening system on the body, the mechanical fastening system comprising a first fastening component disposed on the body in the first region and a second fastening component disposed on the body in the second region, at least a portion of the first fastening component being a hook material, and at least a portion of the second fastening component being a loop material which is stretchable from a relaxed state to an elongated state; whereby when the second fastening component is in an elongated state and in

juxtaposition and contact with the first fastening component the loop material engages the hook material as it moves from an elongated state to a relaxed state.

In another embodiment, a disposable absorbent article for personal wear comprises: a body having first and second end regions and comprising an inner layer for contact with the wearer's skin, at least a portion of the inner layer being liquid permeable, an outer layer in opposed relation with the inner layer, and an absorbent layer disposed between the inner layer and the outer layer; a mechanical fastening system positioned on the body including: a first fastening component disposed on the body in the first end region, at least a portion of the first fastening component being a hook material, and a second fastening component disposed on the body in the second end region, at least a portion of the second fastening component being a loop material which is stretchable and contractible; whereby when the second fastening component is in an elongated state and in juxtaposition and contact with the hook material it further engages the hook material as it moves from an elongated state a contracted state.

In another embodiment, a disposable absorbent article for personal wear comprises: a body having first and second end regions and comprising an inner layer for contact with the wearer's skin, at least a portion of the inner layer being liquid permeable, an outer layer in opposed relation with the inner layer, and an absorbent layer disposed between the inner layer and the outer layer; a mechanical fastening system positioned on the body including: a first fastening component disposed on the body in the first end region and at least a portion of the first fastening component being a hook material, and a second fastening component disposed on the body in the second end region, at least a portion of the second fastening component being a loop material which is contractible upon the application of heat; whereby when the second fastening component is in

juxtaposition and contact with the first fastening component and then heated the second fastening component further engages the hook material as it retracts.

Another aspect of the present invention concerns methods for secure an absorbent article for personal wear. In one embodiment, the method comprises  
5 the steps of: providing an absorbent article having a body having first and second end regions, the body comprising inner layer for contact with the wearer's skin, at least a portion of the inner layer being liquid permeable, an outer layer in opposed relation with the inner layer, and an absorbent layer disposed between the inner layer and the outer layer; providing a mechanical fastening system positioned on  
10 the body including: a first fastening component disposed on the body in the first end region, at least a portion of the first fastening component being a hook material, and a second fastening component disposed on the body in the second end region, at least a portion of the second fastening component being a loop material which is stretchable and contractible; and stretching the loop material and  
15 then placing the stretched loop material overlying and in engagement with the hook material and then contracting the loop material.

In another embodiment, the method comprises the steps of: providing an absorbent article having a body having first and second end regions each having longitudinal edges, the body also having an inner layer for contact with the  
20 wearer's skin, at least a portion of the inner layer being liquid permeable, an outer layer in opposed relation with the inner layer and an absorbent layer disposed between the inner layer and the outer layer; providing a mechanical fastening system positioned on the body including: a first fastening component disposed on the body of the first end region and at least a portion of the first fastening  
25 component being a hook material, and a second fastening component disposed on the body of the second end region, at least a portion of the second fastening

component being a loop material which is retractable; and contacting the loop material in engagement with the hook material and then contracting the loop material.

5 In another embodiment, the method comprises the steps of: providing an absorbent article comprising a body having first and second end regions; providing a mechanical fastening system on the body, the mechanical fastening system comprising a first fastening component disposed on the body in the first end region and a second fastening component disposed on the body in the second end region, at least a portion of the first fastening component being a hook material, and at least a portion of the second fastening component being a loop material which is stretchable from a relaxed state to an elongated state; stretching the second fastening component to an elongated state; engaging the first and second fastening component while the second fastening component is in an elongate state; and allowing the second fastening component to retract from  
10 the elongated state after the first and second components are engaged.  
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#### DEFINITIONS

Within the context of this specification, each term or phrase below will include the following meaning or meanings.

"Bonded" refers to the joining, adhering, connecting, attaching, or the like, of two elements. Two elements will be considered to be bonded together when  
20 they are bonded directly to one another or indirectly to one another, such as when each is directly bonded to intermediate elements.

"Comprising" is inclusive or open-ended and does not exclude additional, unrecited elements or method steps.

"Connected" refers to the joining, adhering, bonding, attaching, or the like, of two elements. Two elements will be considered to be connected together when they are connected directly to one another or indirectly to one another, such as when each is directly connected to intermediate elements.

5 "Disposable" refers to articles which are designed to be discarded after a limited use rather than being laundered or otherwise restored for reuse.

"Disposed," "disposed on," and variations thereof are intended to mean that one element can be integral with another element, or that one element can be a separate structure bonded to or placed with or placed near another element.

10 "Elastic," "elasticized" and "elasticity" mean that property of a material or composite by virtue of which it tends to recover its original size and shape after removal of a force causing a deformation.

"Elastomeric" refers to a material or composite which can be elongated by at least 25 percent of its relaxed length and which will recover, upon release of the applied force, at least 10 percent of its elongation. It is generally preferred that the elastomeric material or composite be capable of being elongated by at least 75 percent, particularly at least 150 percent, and more particularly at least 350 percent, of its relaxed length and recover, upon release of an applied force, at least 50 percent of its elongation.

20 "Fabrics" is used to refer to all of the woven, knitted and nonwoven fibrous webs.

"Flexible" refers to materials which are compliant and which will readily conform to the general shape and contours of the wearer's body.

25 "Force" includes a physical influence exerted by one body on another which produces acceleration of bodies that are free to move and deformation of bodies that are not free to move. Force is expressed in grams per unit area.

"Graphic" refers to any design, pattern, or the like that is visible on an absorbent article.

"Hydrophilic" describes fibers or the surfaces of fibers which are wetted by the aqueous liquids in contact with the fibers. The degree of wetting of the materials can, in turn, be described in terms of the contact angles and the surface tensions of the liquids and materials involved. Equipment and techniques suitable for measuring the wettability of particular fiber materials or blends of fiber materials can be provided by a Cahn SFA-222 Surface Force Analyzer System, or a substantially equivalent system. When measured with this system, fibers having contact angles less than 90° are designated "wetable" or hydrophilic, while fibers having contact angles greater than 90° are designated "nonwetable" or hydrophobic.

"Integral" is used to refer to various portions of a single unitary element rather than separate structures bonded to or placed with or placed near one another.

"Inward" and "outward" refer to positions relative to the center of an absorbent article, and particularly transversely and/or longitudinally closer to or away from the longitudinal and transverse center of the absorbent article.

"Layer" when used in the singular can have the dual meaning of a single element or a plurality of elements.

"Liquid impermeable", when used in describing a layer or multi-layer laminate, means that a liquid, such as urine, will not pass through the layer or laminate, under ordinary use conditions, in a direction generally perpendicular to the plane of the layer or laminate at the point of liquid contact. Liquid, or urine, may spread or be transported parallel to the plane of the liquid impermeable layer

or laminate, but this is not considered to be within the meaning of "liquid impermeable" when used herein.

"Longitudinal" and "transverse" have their customary meaning, as indicated by the longitudinal and transverse axes depicted in Figures 2 and 3. The longitudinal axis lies in the plane of the article and is generally parallel to a vertical plane that bisects a standing wearer into left and right body halves when the article is worn. The transverse axis lies in the plane of the article generally perpendicular to the longitudinal axis. The article as illustrated is longer in the longitudinal direction than in the transverse direction.

"Member" when used in the singular can have the dual meaning of a single element or a plurality of elements.

"Nonwoven" and "nonwoven web" refer to materials and webs of material which are formed without the aid of a textile weaving or knitting process.

"Operatively joined," with reference to the attachment of an elastic member to another element, means that the elastic member when attached to or connected to the element, or treated with heat or chemicals, by stretching, or the like, gives the element elastic properties; and with reference to the attachment of a non-elastic member to another element, means that the member and element can be attached in any suitable manner that permits or allows them to perform the intended or described function of the joinder. The joining, attaching, connecting or the like can be either directly, such as joining either member directly to an element, or can be indirectly by means of another member disposed between the first member and the first element.

"Outer cover graphic" refers to a graphic that is directly visible upon inspection of the exterior surface of a garment, and for a refastenable garment is



in reference to inspection of the exterior surface of the garment when the fastening system is engaged as it would be during use.

"Permanently bonded" refers to the joining, adhering, connecting, attaching, or the like, of two elements of an absorbent garment such that the elements tend to be and remain bonded during normal use conditions of the  
5 absorbent garment.

"Refastenable" refers to the property of two elements being capable of releasable attachment, separation, and subsequent releasable reattachment without substantial permanent deformation or rupture.

10 "Releasably attached," "releasably engaged" and variations thereof refer to two elements being connected or connectable such that the elements tend to remain connected absent a separation force applied to one or both of the elements, and the elements being capable of separation without substantial permanent deformation or rupture. The required separation force is typically  
15 beyond that encountered while wearing the absorbent garment.

"Rupture" means the breaking or tearing apart of a material; in tensile testing, the term refers to the total separation of a material into two parts either all at once or in stages, or the development of a hole in some materials.

20 "Stretch bonded" refers to an elastic member being bonded to another member while the elastic member is extended at least about 25 percent of its relaxed length. Desirably, the term "stretch bonded" refers to the situation wherein the elastic member is extended at least about 100 percent, and more desirably at least about 300 percent, of its relaxed length when it is bonded to the other member.

25 "Stretch bonded laminate" refers to a composite material having at least two layers in which one layer is a gatherable layer and the other layer is an elastic

layer. The layers are joined together when the elastic layer is in an extended condition so that upon relaxing the layers, the gatherable layer is gathered.

"Surface" includes any layer, film, woven, nonwoven, laminate, composite, or the like, whether pervious or impervious to air, gas, and/or liquids.

5 "Tension" includes a uniaxial force tending to cause the extension of a body or the balancing force within that body resisting the extension.

"Thermoplastic" describes a material that softens when exposed to heat and which substantially returns to a nonsoftened condition when cooled to room temperature.

10 These terms may be defined with additional language in the remaining portions of the specification.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features of the present invention and the manner of attaining them will become more apparent, and the invention itself will  
15 be better understood by reference to the following description and the accompanying drawings, wherein similar features in different figures have been given the same reference numeral.

Figure 1 illustrates a side view of a training pant suitable for use with the process and apparatus according to the present invention, where the fastening  
20 system is shown engaged on one side of the training pant and disengaged on the other side of the training pant.

Figure 2 illustrates a plan view of the training pant shown in Figure 1 in an unfastened, stretched and laid flat condition, and showing the surface of the training pant that faces away from the wearer.

Figure 3 illustrates a plan view similar to Figure 2, but showing the surface of the training pant that faces the wearer when the training pant is worn, and with portions cut away to show the underlying features.

5 Figure 4 illustrates an alternative embodiment of the present invention in a side view similar to Figure 1.

Figure 5 is a plan view of the embodiment of Figure 4 in a similar position as Figure 3.

Figure 6 schematically illustrates a flow diagram for manufacture of one embodiment of a pant according to the present invention.

10 Figure 7 illustrates a pant according to one embodiment of the present invention at three stages during manufacture.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 representatively illustrates one embodiment of training pant 20 in a partially fastened condition. The training pant 20 comprises an absorbent body 32 and a fastening system 80. The absorbent body 32 defines a front waist region 22, a back waist region 24, a crotch region 26 interconnecting the front and back waist regions, an inner surface 28 which is configured to contact the wearer, and an outer surface 30 opposite the inner surface which is configured to contact the wearer's clothing. With additional reference to Figures 2 and 3, the absorbent body 32 also defines a pair of transversely opposed side edges 36 and a pair of longitudinally opposed waist edges, which are designated front waist edge 38 and back waist edge 39. The front waist region 22 is contiguous with the front waist edge 38, and the back waist region 24 is contiguous with the back waist edge 39.

25 The illustrated absorbent body 32 comprises a rectangular composite structure 33, a pair of transversely opposed front side panels 34, and a pair of

transversely opposed back side panels 134. The composite structure 33 and side panels 34 and 134 may be integrally formed or comprise two or more separate elements, as shown in Figure 1. The illustrated composite structure 33 comprises an outer cover 40, a bodyside liner 42 (Figure 3) which is connected to the outer cover in a superposed relation, an absorbent assembly 44 (Figure 3) which is located between the outer cover and the bodyside liner, and a pair of containment flaps 46 (Figure 3). The illustrated composite structure 33 has opposite linear end edges 45 that form portions of the front and back waist edges 38 and 39, and opposite linear side edges 47 that form portions of the side edges 36 of the absorbent body 32 (Figures 2 and 3). For reference, arrows 48 and 49 depicting the orientation of the longitudinal axis and the transverse axis, respectively, of the training pant 20 are illustrated in Figures 2 and 3.

With the training pant 20 in the fastened position as partially illustrated in Figure 1, the front and back waist regions 22 and 24 are joined together to define a three-dimensional pant configuration having a waist opening 50 and a pair of leg openings 52. The front waist region 22 comprises the portion of the training pant 20 which, when worn, is positioned on the front of the wearer while the back waist region 24 comprises the portion of the training pant which, when worn, is positioned on the back of the wearer. The crotch region 26 of the training pant 20 comprises the portion of the training pant which, when worn, is positioned between the legs of the wearer and covers the lower torso of the wearer. The front and back side panels 34 and 134 comprise the portions of the training pant 20 which, when worn, are positioned on the hips of the wearer.

The front waist region 22 of the absorbent body 32 includes the transversely opposed front side panels 34 and a front center panel 35 (Figures 2 and 3) positioned between and interconnecting the side panels. The back waist

region 24 of the absorbent body 32 includes the transversely opposed back side panels 134 and a back center panel 135 (Figures 2 and 3) positioned between and interconnecting the side panels. The waist edges 38 and 39 of the absorbent body 32 are configured to encircle the waist of the wearer when worn and provide  
5 the waist opening 50 which defines a waist perimeter dimension. Portions of the transversely opposed side edges 36 in the crotch region 26 generally define the leg openings 52. The waist regions 22 and 24 jointly define a waistband 75 (Figures 1, 4 and 7) that peripherally surrounds the waist opening 50 of the pant 20. The waist regions 22 and 24 also jointly define a hip section 77 (Figures 1, 4  
10 and 7) that encircles the pant 20 and is disposed between the waistband 75 and the leg openings 52.

The absorbent body 32 is configured to contain and/or absorb any body exudates discharged from the wearer. For example, the absorbent body 32 desirably although not necessarily comprises the pair of containment flaps 46  
15 which are configured to provide a barrier to the transverse flow of body exudates. A flap elastic member 53 (Figure 3) is operatively joined with each containment flap 46 in any suitable manner as is well known in the art. The elasticized containment flaps 46 define an unattached edge which assumes an upright configuration in at least the crotch region 26 of the training pant 20 to form a seal  
20 against the wearer's body. The containment flaps 46 can be located along the transversely opposed side edges of the absorbent body 32, and can extend longitudinally along the entire length of the absorbent body or may only extend partially along the length of the absorbent body. Suitable constructions and arrangements for the containment flaps 46 are generally well known to those  
25 skilled in the art and are described in U.S. Patent 4,704,116 issued November 3, 1987 to Enloe, which is incorporated herein by reference.

To further enhance containment and/or absorption of body exudates, the training pant 20 desirably although not necessarily includes a front waist elastic member 54, a rear waist elastic member 56, and leg elastic members 58, as are known to those skilled in the art (Figure 3). The waist elastic members 54 and 56 can be operatively joined to the outer cover 40 and/or bodyside liner 42 along the opposite waist edges 38 and 39, and can extend over part or all of the waist edges, such that the waist elastic members are disposed in the waistband 75 in the fully assembled pant. The leg elastic members 58 are desirably operatively joined to the outer cover 40 and/or bodyside liner 42 along the opposite side edges 36 and positioned in the crotch region 26 of the training pant 20. The leg elastic members 58 can be longitudinally aligned along each side edge 47 of the composite structure 33. Each leg elastic member 58 has a front terminal point 63 and a back terminal point 65, which points represent the longitudinal ends of the elastic gathering caused by the leg elastic members. The front terminal points 63 can be located adjacent the longitudinally innermost parts of the front side panels 34, and the back terminal points 65 can be located adjacent the longitudinally innermost parts of the back side panels 134.

20 *Sub*  
20 *Fig 1*  
The flap elastic members 53, the waist elastic members 54 and 56, and the leg elastic members 58 can be formed of any suitable elastic material. As is well known to those skilled in the art, suitable elastic materials include sheets, strands or ribbons of natural rubber, synthetic rubber, or thermoplastic elastomeric polymers. The elastic materials can be stretched and adhered to a substrate, adhered to a gathered substrate, or adhered to a substrate and then elasticized or shrunk, for example with the application of heat; such that elastic constrictive forces are imparted to the substrate. In one particular embodiment, for example, the leg elastic members 58 comprise a plurality of dry-spun coalesced

multifilament spandex elastomeric threads sold under the trade name LYCRA® and available from E. I. Du Pont de Nemours and Company, Wilmington, Delaware U.S.A.

5 In particular embodiments, the waist elastic members 54 and 56 can be formed of retractive materials. For example, the waist elastic members 54 and 56 can be formed of an elastomeric material that is adapted to retract upon activation by a source of heat such as disclosed in U. S. Patent No. 4,640,726.

10 The outer cover 40 desirably comprises a material that is substantially liquid impermeable, and can be elastic, stretchable or nonstretchable. The outer cover 40 can be a single layer of liquid impermeable material, but desirably comprises a multi-layered laminate structure in which at least one of the layers is liquid impermeable. For instance, the outer cover 40 can include a liquid permeable outer layer and a liquid impermeable inner layer that are suitably joined together by a laminate adhesive, ultrasonic bonds, thermal bonds, or the like. Suitable laminate adhesives, which can be applied continuously or  
15 intermittently as beads, a spray, parallel swirls, or the like, can be obtained from Findley Adhesives, Inc., of Wauwatosa, Wisconsin U.S.A., or from National Starch and Chemical Company, Bridgewater, New Jersey U.S.A. The liquid permeable outer layer can be any suitable material and desirably one that provides a  
20 generally cloth-like texture. One example of such a material is a 20 gsm (grams per square meter) spunbond polypropylene nonwoven web. The outer layer may also be made of those materials of which liquid permeable bodyside liner 42 is made. While it is not a necessity for outer layer to be liquid permeable, it is desired that it provides a relatively cloth-like texture to the wearer.

25 The inner layer of the outer cover 40 can be both liquid and vapor impermeable, or can be liquid impermeable and vapor permeable. The inner layer

is desirably manufactured from a thin plastic film, although other flexible liquid impermeable materials may also be used. The inner layer, or the liquid impermeable outer cover 40 when a single layer, prevents waste material from wetting articles, such as bedsheets and clothing, as well as the wearer and  
5 caregiver. A suitable liquid impermeable film for use as a liquid impermeable inner layer, or a single layer liquid impermeable outer cover 40, is a 0.02 millimeter polyethylene film commercially available from Huntsman Packaging of Newport News, Virginia U.S.A. If the outer cover 40 is a single layer of material, it can be embossed and/or matte finished to provide a more cloth-like appearance. As  
10 earlier mentioned, the liquid impermeable material can permit vapors to escape from the interior of the disposable absorbent article, while still preventing liquids from passing through the outer cover 40. A suitable "breathable" material is composed of a microporous polymer film or a nonwoven fabric that has been coated or otherwise treated to impart a desired level of liquid impermeability. A  
15 suitable microporous film is a PMP-1 film material commercially available from Mitsui Toatsu Chemicals, Inc., Tokyo, Japan, or an XKO-8044 polyolefin film commercially available from 3M Company, Minneapolis, Minnesota U.S.A.

As shown in Figures 1 and 2, the training pant 20 and in particular the outer cover 40 desirably comprises one or more appearance-related components.  
20 Examples of appearance-related components include, but are not limited to, graphics; highlighting or emphasizing leg and waist openings in order to make product shaping more evident or visible to the user; highlighting or emphasizing areas of the product to simulate functional components such as elastic leg bands, elastic waistbands, simulated "fly openings" for boys, ruffles for girls; highlighting  
25 areas of the product to change the appearance of the size of the product; registering wetness indicators, temperature indicators, and the like in the product;



registering a back label, or a front label, in the product; and registering written instructions at a desired location in the product.

The illustrated training pant 20, which is designed for use by young girls, includes a registered outer cover graphic 60. In this design, the registered graphic 5 60 includes a primary pictorial image 61, simulated waist ruffles 62, and simulated leg ruffles 64. The primary pictorial image 61 includes a rainbow, sun, clouds, animal characters, wagon and balloons. Any suitable design can be utilized for a training pant intended for use by young girls, so as to be aesthetically and/or functionally pleasing to them and the caregiver. The appearance-related 10 components are desirably positioned on the training pant 20 at selected locations, which can be carried out using the methods disclosed in U.S. Patent 5,766,389 issued June 16, 1998 to Brandon et al., which is incorporated herein by reference. The primary pictorial image 61 is desirably positioned in the front waist region 22 along the longitudinal centerline of the training pant 20.

15 The liquid permeable bodyside liner 42 is illustrated as overlying the outer cover 40 and absorbent assembly 44, and may but need not have the same dimensions as the outer cover 40. The bodyside liner 42 is desirably compliant, soft feeling, and non-irritating to the child's skin. Further, the bodyside liner 42 can be less hydrophilic than the absorbent assembly 44, to present a relatively dry 20 surface to the wearer and permit liquid to readily penetrate through its thickness. Alternatively, the bodyside liner 42 can be more hydrophilic or can have essentially the same affinity for moisture as the absorbent assembly 44 to present a relatively wet surface to the wearer to increase the sensation of being wet. This wet sensation can be useful as a training aid. The hydrophilic/hydrophobic 25 properties can be varied across the length, width and depth of the bodyside liner

42 and absorbent assembly 44 to achieve the desired wetness sensation or leakage performance.

The bodyside liner 42 can be manufactured from a wide selection of web materials, such as synthetic fibers (for example, polyester or polypropylene fibers), natural fibers (for example, wood or cotton fibers), a combination of natural and synthetic fibers, porous foams, reticulated foams, apertured plastic films, or the like. Various woven and nonwoven fabrics can be used for the bodyside liner 42. For example, the bodyside liner can be composed of a meltblown or spunbonded web of polyolefin fibers. The bodyside liner can also be a bonded-carded web composed of natural and/or synthetic fibers. The bodyside liner can be composed of a substantially hydrophobic material, and the hydrophobic material can, optionally, be treated with a surfactant or otherwise processed to impart a desired level of wettability and hydrophilicity. For example, the material can be surface treated with about 0.45 weight percent of a surfactant mixture comprising Ahcovel N-62 from Hodgson Textile Chemicals of Mount Holly, North Carolina U.S.A. and Glucopan 220UP from Henkel Corporation of Ambler, Pennsylvania in an active ratio of 3:1. The surfactant can be applied by any conventional means, such as spraying, printing, brush coating or the like. The surfactant can be applied to the entire bodyside liner 42 or can be selectively applied to particular sections of the bodyside liner, such as the medial section along the longitudinal centerline.

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A suitable liquid permeable bodyside liner 42 is a nonwoven bicomponent web having a basis weight of about 27 gsm. The nonwoven bicomponent can be a spunbond bicomponent web, or a bonded carded bicomponent web. Suitable bicomponent staple fibers include a polyethylene/polypropylene bicomponent fiber available from CHISSO Corporation, Osaka, Japan. In this particular bicomponent

fiber, the polypropylene forms the core and the polyethylene forms the sheath of the fiber. Other fiber orientations are possible, such as multi-lobe, side-by-side, end-to-end, or the like.

The absorbent assembly 44 (Figure 3) is positioned between the outer  
5 cover 40 and the bodyside liner 42, which components can be joined together by any suitable means such as adhesives, ultrasonic bonds, thermal bonds, or the like. The absorbent assembly 44 can be any structure which is generally compressible, conformable, non-irritating to the child's skin, and capable of absorbing and retaining liquids and certain body wastes. The absorbent assembly  
10 44 can be manufactured in a wide variety of sizes and shapes, and from a wide variety of liquid absorbent materials commonly used in the art. For example, the absorbent assembly 44 can suitably comprise a matrix of hydrophilic fibers, such as a web of cellulosic fluff, mixed with particles of a high-absorbency material commonly known as superabsorbent material. In a particular embodiment, the  
15 absorbent assembly 44 comprises a matrix of cellulosic fluff, such as wood pulp fluff, and superabsorbent hydrogel-forming particles. The wood pulp fluff can be exchanged with synthetic, polymeric, meltblown fibers or short cut homofil bicomponent synthetic fibers and natural fibers. The superabsorbent particles can be substantially homogeneously mixed with the hydrophilic fibers or can be  
20 nonuniformly mixed. The fluff and superabsorbent particles can also be selectively placed into desired zones of the absorbent assembly 44 to better contain and absorb body exudates. The concentration of the superabsorbent particles can also vary through the thickness of the absorbent assembly 44. Alternatively, the absorbent assembly 44 can comprise a laminate of fibrous webs and  
25 superabsorbent material or other suitable means of maintaining a superabsorbent material in a localized area.

Suitable superabsorbent materials can be selected from natural, synthetic, and modified natural polymers and materials. The superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds, such as crosslinked polymers, for example, sodium neutralized polyacrylic acid. Suitable  
5 superabsorbent materials are available from various commercial vendors, such as Dow Chemical Company located in Midland, Michigan U.S.A., and Stockhausen GmbH & Co. KG, D-47805 Krefeld, Federal Republic of Germany. Typically, a superabsorbent material is capable of absorbing at least about 15 times its weight in water, and desirably is capable of absorbing more than about 25 times its  
10 weight in water.

In one embodiment, the absorbent assembly 44 is generally rectangular in shape, and comprises a blend of wood pulp fluff and superabsorbent material. One preferred type of pulp is identified with the trade designation CR1654, available from U.S. Alliance, Childersburg, Alabama U.S.A., and is a bleached,  
15 highly absorbent sulfate wood pulp containing primarily soft wood fibers and about 16 percent hardwood fibers. As a general rule, the superabsorbent material is present in the absorbent assembly 44 in an amount of from about 5 to about 90 weight percent based on total weight of the absorbent assembly. The absorbent assembly 44 suitably has a density within the range of about 0.10 to about 0.35  
20 grams per cubic centimeter. The absorbent assembly 44 may or may not be wrapped or encompassed by a suitable tissue wrap that may help maintain the integrity and/or shape of the absorbent assembly.

The absorbent body 32 can also incorporate other materials that are designed primarily to receive, temporarily store, and/or transport liquid along the  
25 mutually facing surface with absorbent assembly 44, thereby maximizing the absorbent capacity of the absorbent assembly. One suitable material is referred to

as a surge layer (not shown) and comprises a material having a basis weight of about 50 to about 120 grams per square meter, and comprising a through-air-bonded-carded web of a homogenous blend of 60 percent 3 denier type T-256 bicomponent fiber comprising a polyester core/polyethylene sheath and 40 percent 6 denier type T-295 polyester fiber, both commercially available from Kosa Corporation of Salisbury, North Carolina U.S.A.

As noted previously, the illustrated training pant 20 has front and back side panels 34 and 134 disposed on each side of the absorbent body 32. These transversely opposed front side panels 34 and transversely opposed back side panels 134 can be permanently bonded along attachment lines 66 to the composite structure 33 of the absorbent body 32 in the respective front and back waist regions 22 and 24. More particularly, as shown best in Figures 2 and 3, the front side panels 34 can be permanently bonded to and extend transversely beyond the linear side edges 47 of the composite structure 33 in the front waist region 22, and the back side panels 134 can be permanently bonded to and extend transversely beyond the linear side edges of the composite structure in the back waist region 24. The side panels 34 and 134 may be attached using attachment means known to those skilled in the art such as adhesive, thermal or ultrasonic bonding. Alternatively, the side panels 34 and 134 can be formed as a portion of a component of the composite structure 33. For example, the side panels can comprise a generally wider portion of the outer cover, the bodyside liner, and/or another component of the absorbent body. Thus, the pant 20 can include a one-piece chassis, such as an allover stretch outer cover.

The illustrated side panels 34 and 134 each define a distal edge 68 that is spaced from the attachment line 66, a leg end edge 70 disposed toward the longitudinal center of the training pant 20, and a waist end edge 72 disposed

toward a longitudinal end of the training pant. The leg end edge 70 and waist end edge 72 extend from the side edges 47 of the composite structure 33 to the distal edges 68. The leg end edges 70 of the side panels 34 and 134 form part of the side edges 36 of the absorbent body 32. In the back waist region 24, the leg end edges 70 are desirably although not necessarily curved and/or angled relative to the transverse axis 49 to provide greater coverage toward the back of the pant as compared to the front of the pant. The waist end edges 72 are desirably parallel to the transverse axis 49. The waist end edges 72 of the front side panels 34 form part of the front waist edge 38 of the absorbent body 32, and the waist end edges 72 of the back side panels 134 form part of the back waist edge 39 of the absorbent body.

In particular embodiments for improved fit and appearance, the side panels 34 and 134 desirably have an average length dimension measured parallel to the longitudinal axis 48 that is about 20 percent or greater, and particularly about 25 percent or greater, of the overall length dimension of the absorbent article, also measured parallel to the longitudinal axis 48. For example, in training pants having an overall length dimension of about 54 centimeters, the side panels 34 and 134 desirably have an average length dimension of about 10 centimeters or greater, such as about 15 centimeters. While each of the side panels 34 and 134 extend from the waist opening 50 to one of the leg openings 52, the back side panels 134 have a continually decreasing length dimension moving from the attachment line 66 to the distal edge 68, as is best shown in Figures 2 and 3.

Each of the side panels 34 and 134 can include one or more individual, distinct pieces of material. In particular embodiments, for example, each side panel 34 and 134 can include first and second side panel portions that are joined at a seam, or can include a single piece of material which is folded over upon

itself (not shown). The side panels 34 and 134 desirably although not necessarily  
comprise an elastic material capable of stretching in a direction generally parallel  
to the transverse axis 49 of the training pant 20. Solely by way of illustration,  
suitable elastic side panels 34 and 134 can be stretchable from about 150 percent  
5 to about 450 percent. This means that a panel having a relaxed length of 10  
millimeters (mm) when stretched 5 mm would have been stretched 150 percent of  
its original length. Elastic materials if provided over the entire front and/or back  
region of pant 20 could fit well with lower stretch, for example from about 150  
percent to about 250 percent. In embodiments where the entire front and/or back  
10 region panel is not stretchable, then higher levels of stretch, for example, about  
250 percent to about 450 percent may be preferred.

Suitable elastic materials, as well as one process of incorporating elastic  
side panels into a training pant, are described in the following U.S. Patents:  
4,940,464 issued July 10, 1990 to Van Gompel et al.; 5,224,405 issued July 6,  
15 1993 to Pohjola; 5,104,116 issued April 14, 1992 to Pohjola; and 5,046,272  
issued September 10, 1991 to Vogt et al.; all of which are incorporated herein by  
reference. In particular embodiments, the elastic material comprises a stretch-  
thermal laminate, a neck-bonded laminate, a reversibly necked laminate, or a  
stretch-bonded laminate material. Methods of making such materials are well  
20 known to those skilled in the art and described in U.S. Patent 4,663,220 issued  
May 5, 1987 to Wisneski et al.; U.S. Patent 5,226,992 issued July 13, 1993 to  
Mormon; and European Patent Application No. EP 0 217 032 published on April 8,  
1987 in the names of Taylor et al.; all of which are incorporated herein by  
reference. Alternatively, the side panel material may comprise other woven or  
25 nonwoven materials, such as those described above as being suitable for the

outer cover 40 or bodyside liner 42; mechanically prestrained materials; and/or stretchable but inelastic materials.

In particular embodiments, one or more of the side panels 34 and 134 can be formed of retractive materials. For example, the side panels 34 and 134 can be formed of an elastomeric material that is adapted to retract upon activation by a source of heat, such as disclosed in U.S. Patent No. 4,640,726.

The illustrated training pant 20 includes a fastening system 80 for refastenably securing the training pant about the waist of the wearer. The illustrated fastening system 80 includes first fastening components 82 and 83 that are adapted to refastenably connect to mating second fastening components 84 and 85. In one embodiment, one surface of each of the first fastening components 82 and 83 comprises a plurality of engaging elements that project from that surface. The engaging elements of the first fastening components 82 and 83 are adapted to repeatedly engage and disengage engaging elements of the second fastening components 84 and 85.

In one particular embodiment, the first fastening components 82 and 83 each comprise hook type fasteners and the second fastening components 84 and 85 each comprise complementary loop type fasteners. In another particular embodiment, the first fastening components 82 and 83 each comprise loop type fasteners and the second fastening components 84 and 85 each comprise complementary hook type fasteners. Although the illustrated embodiments show the back waist region 24 overlapping the front waist region 22, which is convenient, the training pant 20 can also be configured so that the front waist region overlaps the back waist region.

Hook type fasteners typically comprise a fabric or material having a base or backing structure and a plurality of hook members extending upwardly from at



least one surface of the backing structure. The hook material advantageously comprises a resilient material to minimize unintentional disengagement of the fastener components as a result of the hook material becoming deformed and catching on clothing or other items. The term "resilient" as used herein refers to an interlocking material having a predetermined shape and the property of the interlocking material to resume the predetermined shape after being engaged and disengaged from a mating, complementary interlocking material. Suitable hook material can be molded or extruded of nylon, polypropylene or another suitable material. Suitable single-sided hook materials for the fastening components 82-85 are available from commercial vendors such as Velcro Industries B.V., Amsterdam, Netherlands or affiliates thereof, and are identified as Velcro HTH-829 with a uni-directional hook pattern and having a thickness of about 0.9 millimeters (35 mils) and HTH-851 with a uni-directional hook pattern and having a thickness of about 0.5 millimeters (20 mils); and Minnesota Mining & Manufacturing Co., St. Paul, Minnesota U.S.A., including specific materials identified as CS-600. Hook materials could be made with elastic material with base polymer such as urethane, KRAYTON or PEBAX.

In accordance with the present invention, the loop type fastener is preferably made of a stretchable or extensible material which may include a stretch bonded laminate, and which may be elastomeric. In particular embodiments, the loop material can be mounted to a base of stretchable material so the assembly is stretchable. Alternatively, the loop material may be a retractable material which retracts on application of heat as described more fully below in connection with one particular embodiment.

With particular reference to Figure 3, the first fastening components 82 and 83 are desirably although not necessarily disposed on the inner surface 28 of the

training pant 20 in the back waist region 24. The first fastening components 82 and 83 are desirably positioned along the distal edges 68 of the back side panels 134, and abutting or adjacent to the waist end edge 72. In certain embodiments, for example, the first fastening components 82 and 83 can be located within about 5 2 centimeters, and more particularly within about 1 centimeter, of the distal edges 68, the waist end edges 72, and the leg end edges 70.

With particular reference to Figure 2, the second fastening components 84 and 85 are desirably although not necessarily disposed on the outer surface 30 of the training pant 20 in the front waist region 22, although it is contemplated that 10 the fastening components can be placed anywhere on the pant so long as they help to hold the pant on the wearer. The second fastening components 84 and 85 are sized to receive the first fastening components 82 and 83 and are desirably positioned along the distal edges 68 of the front side panels 34, and abutting or adjacent to the waist end edge 72. In certain embodiments, for example, the 15 second fastening components 84 and 85 can be located within about 2 centimeters, and more particularly within about 1 centimeter, of the distal edges 68, the waist end edges 72, and the leg end edges 70. Where the first fastening components 82 and 83 comprise loop type fasteners disposed on the inner surface 28 and the second fastening components 84 and 85 comprise hook type 20 fasteners disposed on the outer surface 30, the first fastening components can be sized larger than the second fastening components to ensure coverage of the rigid, outwardly-directed hooks. The loop fastening components can be integral with the side panels or adhered to the side panels 34 and 134 by any means known to those skilled in the art such as adhesive bonds, sonic bonds or thermal 25 bonds. The loop fastening components can be extensible and bonded to

components of the body 32 in a manner that retains extension and retraction characteristics of the loop fastening components.

The fastening components are desirably rectangular, although they may alternatively be square, round, oval, curved or otherwise non-rectangularly shaped. In particular embodiments, each of the fastening components 82-85 defines a length dimension aligned generally parallel with the longitudinal axis 48 of the training pant 20 and a width dimension aligned generally parallel with the transverse axis 49 of the training pant. For a child of about 9 to about 15 kilograms (20-30 pounds), for example, the length dimension of the fastening components is desirably from about 5 to about 13 centimeters, such as about 10 centimeters, and the width dimension is desirably from about 0.5 to about 3 centimeters, such as about 1 centimeter. With particular embodiments, the fastening components can have a length-to-width ratio of about 2 or greater, such as about 2 to about 25, and particularly about 5 or greater, such as about 5 to about 8. For other embodiments such as for adult products, it may be desirable for one or more of the fastening components to comprise a plurality of relatively smaller fastening elements. In that case, a fastening component or individual fastening elements may have an even smaller length-to-width ratio, for example, of about 2 or less, and even about 1 or less.

When the fastening components 82-85 are releasably engaged, the side edges 36 of the absorbent body 32 in the crotch region 26 define the leg openings 52, the waist edges 38 and 39 of the absorbent body, including the waist end edges 72 of the side panels, define the waist opening 50, and the waist regions 22 and 24 jointly define a waistband 75 and hip section 77. For improved formation of the leg openings 52, it can be desirable in some embodiments for the front side panels 34 to be longitudinally spaced from the back side panels 134 (see Figures

2 and 3). For example, the front side panels 34 can be longitudinally spaced from the back side panels 134 by a distance equal to about 20 percent or greater, particularly from about 20 to about 60 percent, and more particularly from about 35 to about 50 percent, of the overall length dimension of the absorbent article.

5           When connected, the fastening components 82-85 form refastenable seams 88 (Figure 1) that desirably although not necessarily extend substantially the entire distance between the waist opening 50 and the leg openings 52. More specifically, the refastenable seams 88 can cover about 80 to 100 percent, and particularly about 90 to about 98 percent, of the distance between the waist  
10 opening 50 and each leg opening 52, which distance is measured parallel to the longitudinal axis 48. To construct the seams 88 to extend substantially the entire distance between the waist and leg openings 50 and 52, the fastening components 82-85 can be formed to cover about 80 to 100 percent, and more particularly about 90 to about 98 percent, of the distance between the waist end  
15 edge 70 and the leg end edge 72 of the side panels 34 and 134. In other embodiments, the fastening components can comprise a plurality of smaller fastening elements covering a smaller portion of the distance between the waist opening 50 and the leg openings 52, for example, about 20 to about 70 percent, but spaced apart to span a larger percentage of the distance between the waist  
20 opening and the leg openings.

          For the refastenable seams 88 to be located at the sides of the wearer, it can be particularly desirable for the transverse distance between the first fastening components 82 and 83 to be substantially equal to the transverse distance between the second fastening components 84 and 85. The transverse  
25 distance between a set of fasteners is the distance measured parallel to the transverse axis 49 between the longitudinal centerlines of the fasteners,

measured with the side panels 34 and 134 in an unstretched condition. In an alternative embodiment, the training pant 20 includes only a single second fastening component disposed in the front waist region 22 for refastenably connecting the first fastening components 82 and 83 (not shown).

5           In a further alternative embodiment illustrated in Figures 4 and 5, one or both of the fastening components can comprise integral portions of the waist regions. For instance, one of the elastomeric front or back side panels 34 and 134, respectively, can function as second fastening components in that they can comprise a material that is releasably engageable with fastening components  
10 disposed in the opposite waist region. As illustrated in Figures 4 and 5, the side panels 134 are made completely of stretchable loop material although, alternatively, these side panels could be made of loop material only at there outer ends where they will engage the hook material and the remainder of the side panels can be made of some other, preferably stretchable, material and joined  
15 along abutting edges thereof.

Figure 6 schematically illustrates a flow diagram for manufacture of one embodiment of a pant according to the present invention. The components of the pants 20 can be provided and bonded together in an assembly section 200, typically in the form of a continuous web of interconnected and partially  
20 assembled pants. The assembly section 200 can include a cutting mechanism which selectively cuts the web into discrete, partially assembled training pants.

The discrete training pants can then be folded at a folding station 202 using any suitable folding mechanism. The training pants 102 can be folded about a fold line generally bisecting the training pants. As such, the waist regions 22 and 24 of  
25 each training pant can be positioned in facing relationship with the side panels 34 and 134 extending laterally outward relative to the longitudinal axis 48 of the

training pant. The fold line can extend in a lateral direction through the crotch region 26 of the training pant. Desirably, the discrete training pants are consistently folded about the fold line such that the front and back waist edges 38 and 39 of the training pants align with each other.

5           The opposed side panels 34 and 134 can also be folded in the folding section 202. The side panels 34 and 134 can desirably be folded parallel to the longitudinal centerline of the training pants so that at least portions of the first and second fastening components overlap with one another. The side panels 34 and 134 can alternatively be folded together in conjunction with engagement of the  
10 first and second fastening components 82-85 in a seaming section 204. The seaming section 204 forms the refastenable seams 88 of the pants 20. Suitable devices to inwardly fold the side panels 34 and 134 parallel to the longitudinal centerline can include folding boards, folding skis, paddles, fingers, vacuum devices, air blasts, mechanical devices with reciprocating motion such as tuckers,  
15 four-bar linkages, slide-crank mechanisms, or the like and combinations thereof which are preferably adapted to stretch or extend the fastening component formed of loop material prior to its being placed on the fastening component formed of hook material.

          The training pants 20 can be transported to an activation station 206, which  
20 can but need not necessarily follow the seaming section 204 as illustrated. The activation station 206 can comprise an activation source such as a heating unit to instigate retraction of the retractive material in those constructions which use a heat activated retractive material in any components of the pants 20, including the loop-type fastening material. It is contemplated that materials which shrink or  
25 contract through other means can also be utilized in the present invention, such as disclosed in United States Patent No. 4,883,549, incorporated herein by

reference, or simply by slow responding material. The activation station 206 can comprise a separate stage of the manufacturing operation or can be incorporated into another stage. In particular embodiments, the activation station 206 can be combined with devices such as product stackers for packaging the pants 20.

5 Suitable devices incorporating activation mechanisms are disclosed in U.S. Patents 4,640,726 issued February 3, 1987 to Sallee et al. and 4,663,106 issued May 5, 1987 to Pomplun et al., which are incorporated herein by reference. In the illustrated embodiment, at least a portion of the retractive material is activated and caused to retract subsequent to engagement of the fastening components 82-85.

10 While the loop-type fastening material was described in particular embodiments as comprising a retractive material, other components of the training pant such as distinct elements or portions of the outer cover, bodyside liner, absorbent assembly, waist elastics, side panels or fastening components can alternatively or additionally comprise retractive materials.

15 Figure 7 illustrates a training pant 300 at three stages during manufacture, denoted with reference numerals 301, 302 and 303. The training pant 300 is similar to the training pant 20 shown in Figure 1, although the front side panels 34 are narrower than the back side panels 134. The training pant 300 at stage 301 has been folded through the crotch region 26 to overlap the waist regions 22 and 24 and the hip regions. At stage 302, one or both pairs of side panels 34 and 134  
20 of the training pant 300 can be folded along fold lines 306 which are parallel to the longitudinal centerline 308 of the training pant. With the fastening components 82-85 engaged, the waist regions 22 and 24 define the waistband 75 and hip section 77, both of which encircle the pant 300 between the crotch region 26 and the  
25 waist opening. The waistband 75 is contiguous with the waist opening 50 (Figure 1) while the hip section 77 is disposed between the waistband and the leg

openings 52 (Figure 1). At stage 303, the retractive materials forming the waist elastic members 54 and 56, the side panels 34 and 134, and/or other components, such as loop-type fastening material, can be activated and the retractive materials allowed to retract.

5           When the training pants 20, or other garment formed in accordance with the present invention, are manually formed into a three dimensional garment to fit a wearer, as illustrated in Fig. 1, by manual manipulation as the garment is being placed on the wearer, the fastening components 82 and 83 that contain the loop material and rear side panels 134 are stretched toward the front side panels 34 and then applied to the respective hook material 84 and 85 on the front side panels 34. The loop material and side panels are then released and allowed to contract on the hook material to produce a mechanical fastener system which exhibits greater engagement strength than conventional mechanical fastening systems. Alternatively, it is contemplated that the loop material can be held under tension and the hook material applied to it or any other means for causing engagement between the hook and loop material while the loop material is in an extended or stretched state and then allowed to retract.

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As discussed above, it is also contemplated that when the training pants or the like garment are being initially constructed and folded by machine, the loop material and/or its underlying support material of the various embodiments described above can be extended and placed in engagement with the hook material and then pressed thereon to give an initial construction that is stronger in the mechanical fastener system than conventional mechanical fastening systems. Also as mentioned above, in an alternative embodiment where the garment is constructed and assembled by machine the loop material may be a retractive material that is simply placed on the hook material during making of the garment

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and then the hook material can be shrunk by an application of heat to embed the hooks into the loop material. Alternatively, as mentioned above, the loop material can retract in other ways, such as temporarily inhibiting retraction of a stretched elastic member as described in United States Patent No. 4,883,549, or other  
5 means such as light motion, pressure exerted, etc.

It is believed that the stretch in the loop material increases the amount of engagement such a fastening system obtains, reducing the occurrence of "pop opens" (refastenable side panels with hook-and-loop disengaging) over conventional hook-and-loop fasteners.

10 It is believed that a wide range of hook-and-loop materials would be suitable for use in the present invention, so long as the loop material is sufficiently stretchable to exhibit the desired enhanced engagement capabilities that produce the desired reduction in "pop opens" over conventional hook-and-loop fasteners. For example, in the embodiment of Figures 3 and 4, it is desirable that the loop  
15 material side panels exhibit a high stretchability of approximately 150 to 300 percent although greater stretchability such as from 300 to 450 percent of at least the loop portion of the side panel, can be exhibited by the material. In its preferred form it is desirable that the loop material be constructed of a extensible material such as but not limited to a stretch bonded material.

20 While the mechanical fastening means of the present invention are shown and described herein in connection with children's toilet training pants, it is understood that such fastening means may be incorporated into various other disposable absorbent articles, such as diapers, adult incontinence garments, sanitary napkins and the like, as well as surgical bandages and sponges, without  
25 departing from the scope of the present invention.

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As various changes could be made in the above constructions and methods, without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

- 5 When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles "a", "an", "the" and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including" and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements.